u-boot runtime modify Linux device tree(dtb)

Biyong SUN

20, OCT 2021

Case Description

In some cases, i.MX board connect to different module. It has very tiny changes, such as just one gpio different driver strength.

We can build an entire new software to handle this requirement.

Here we introduce another way, using u-boot to modify the device tree(dtb) at runtime.

Demo environment

HW: i.MX8MM EVK Pad/Pin NAND_READY_B to do demo

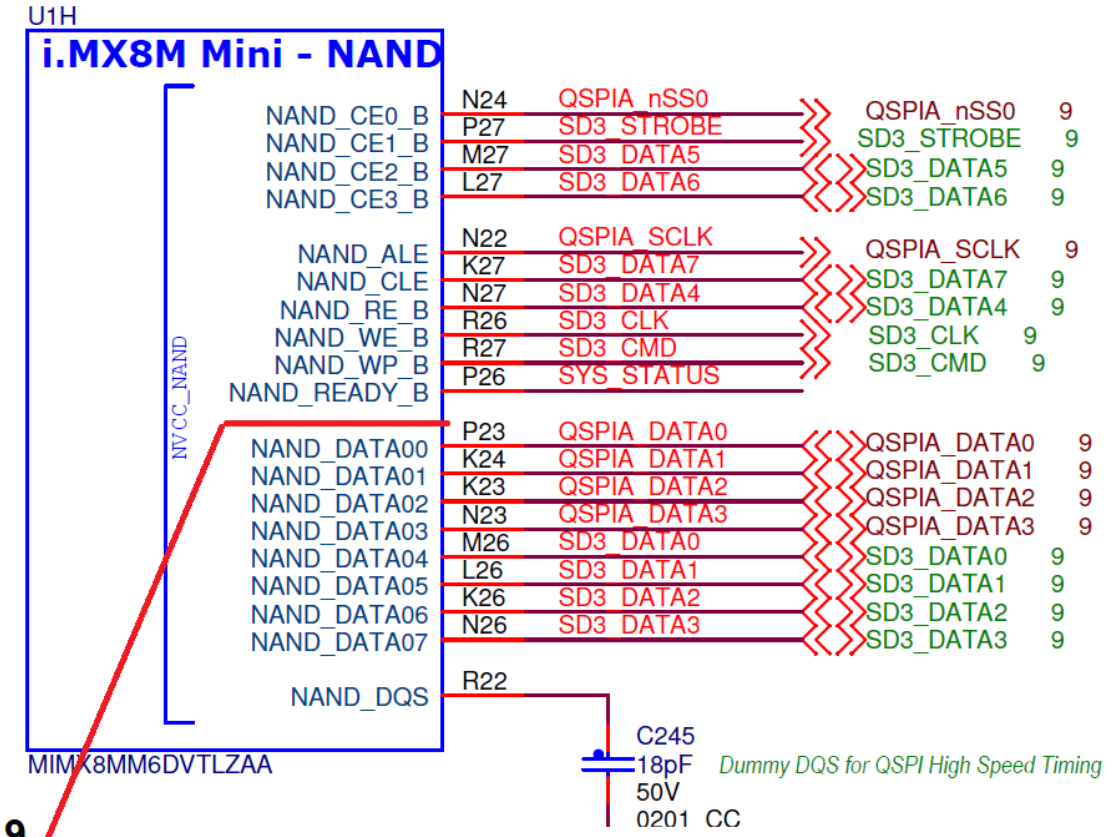
SW: LF_v5.10.35_2.0.0

linux/arch/arm64/boot/dts/freescale/imx8mm-evk.dtsi

```
leds {
        compatible = "gpio-leds";
        pinctrl-names = "default";
        pinctrl-0 = <&pinctrl_gpio_led>;

        status {
                label = "status";
                gpios = <&gpio3 16 GPIO_ACTIVE_HIGH>;
                default-state = "on";
        };
};

pinctrl_gpio_led: gpioledgrp {
        fsl,pins = <
                MX8MM_IOMUXC_NAND_READY_B_GPIO3_IO16    0x19
        >;
};
```



Demo

First, we check the original settings of NAND_READY_B in **Linux**

root@imx8mmevk:~# cat /sys/kernel/debug/pinctrl/pinctrl-maps|grep -B 4 -A 1
MX8MM_IOMUXC_NAND_READY_B
device leds
state default
type CONFIGS_PIN (3)
controlling device 30330000.pinctrl
pin MX8MM_IOMUXC_NAND_READY_B
config 00000019

The we reboot the board and get into u-boot

Demo(cont.)

The we reboot the board and get into **u-boot**

run loadfdt
fdt addr ${fdt_addr_r}
fdt print /soc/bus/pinctrl/gpioledgrp

u-boot=> fdt print /soc/bus/pinctrl/gpioledgrp
gpioledgrp {
	fsl,pins = <0x00000134 0x0000039c 0x00000000 0x00000005 0x00000000 0x00000**19**>;
	phandle = <0x00000072>;
};

Modify to 0x00000**1b** from 0x00000**19**
fdt set   /soc/bus/pinctrl/gpioledgrp/ fsl,pins <0x00000134 0x0000039c 0x00000000 0x00000005 0x00000000 0x00000**1b**>

u-boot=> fdt print /soc/bus/pinctrl/gpioledgrp
gpioledgrp {
	fsl,pins = <0x00000134 0x0000039c 0x00000000 0x00000005 0x00000000 0x00000**1b**>;
	phandle = <0x00000072>;
};

Demo(cont.)

Boot into **Linux** and check the result

Before we already run “run loadfdt”, please do not run again.
Because we have modified the dtb. If you run again, the dtb will load from eMMC, again.

run mmcargs
run loadimage
booti ${loadaddr} - ${fdt_addr_r}

root@imx8mmevk:~# cat /sys/kernel/debug/pinctrl/pinctrl-maps|grep -B 4 -A 1 MX8MM_IOMUXC_NAND_READY_B
device leds
state default
type CONFIGS_PIN (3)
controlling device 30330000.pinctrl
pin MX8MM_IOMUXC_NAND_READY_B
config 000000**1b**

Demo(cont.)

Make it persistent

setenv modify_dtb 'echo modify device tree - doing;fdt addr ${fdt_addr_r};fdt set /soc/bus/pinctrl/gpioledgrp/ fsl,pins <0x00000134 0x0000039c 0x00000000 0x00000005 0x00000000 0x0000001b>’

setenv loadfdt 'fatload mmc ${mmcdev}:${mmcpart} ${fdt_addr_r} ${fdtfile};run modify_dtb’

savee

Demo nodify the mmc2

Check in Linux before modification

root@imx8mmevk:~# cat /sys/kernel/debug/mmc2/ios

```
clock:          200000000 Hz
vdd:            21 (3.3 ~ 3.4 V)
bus mode:       2 (push-pull)
chip select:    0 (don't care)
power mode:     2 (on)
bus width:      3 (8 bits)
timing spec:    10 (mmc HS400 enhanced strobe)
signal voltage: 1 (1.80 V)
driver type:    0 (driver type B)
```

root@imx8mmevk:~# ls -l /proc/device-tree/soc\@0/bus\@30800000/mmc@30b60000/

```
total 0
-r--r--r-- 1 root root  4 Mar 24 10:47 assigned-clock-rates
-r--r--r-- 1 root root  8 Mar 24 10:47 assigned-clocks
-r--r--r-- 1 root root  4 Mar 24 10:47 bus-width
-r--r--r-- 1 root root 12 Mar 24 10:47 clock-names
-r--r--r-- 1 root root 24 Mar 24 10:47 clocks
-r--r--r-- 1 root root 33 Mar 24 10:47 compatible
-r--r--r-- 1 root root  4 Mar 24 10:47 fsl,tuning-start-tap
-r--r--r-- 1 root root  4 Mar 24 10:47 fsl,tuning-step
-r--r--r-- 1 root root 12 Mar 24 10:47 interrupts
-r--r--r-- 1 root root  4 Mar 24 10:47 name
-r--r--r-- 1 root root  0 Mar 24 10:47 non-removable
-r--r--r-- 1 root root  4 Mar 24 10:47 pinctrl-0
-r--r--r-- 1 root root  4 Mar 24 10:47 pinctrl-1
-r--r--r-- 1 root root  4 Mar 24 10:47 pinctrl-2
-r--r--r-- 1 root root 34 Mar 24 10:47 pinctrl-names
-r--r--r-- 1 root root  8 Mar 24 10:47 reg
-r--r--r-- 1 root root  5 Mar 24 10:47 status
```

Demo nodify the mmc2(cont.)

```
u-boot=> run loadfdt
u-boot=> fdt addr ${fdt_addr_r}

u-boot=> fdt list   /aliases
aliases {
        "/soc@0/bus@30800000/ethernet@30be0000";
        gpio0 = "/soc@0/bus@30000000/gpio@30200000";

      ……
…        i2c3 = "/soc@0/bus@30800000/i2c@30a50000";
        mmc0 = "/soc@0/bus@30800000/mmc@30b40000";
        mmc1 = "/soc@0/bus@30800000/mmc@30b50000";
        mmc2 = "/soc@0/bus@30800000/mmc@30b60000";
        sai1 = "/soc@0/bus@30000000/sai@30010000";
        ……
        serial3 = "/soc@0/bus@30800000/serial@30a60000";
        spi0 = "/soc@0/bus@30800000/spi@30bb0000";
        spi1 = "/soc@0/bus@30800000/spi@30830000";
        spi2 = "/soc@0/bus@30800000/spi@30840000"
```

```
u-boot=>  fdt resize
u-boot=> fdt set  mmc2 no-1-8-v
u-boot=> fdt print  mmc2

mmc@30b60000 {
        no-1-8-v;
        compatible = "fsl,imx8mm-usdhc", "fsl,imx7d-usdhc";
        reg = <0x30b60000 0x00010000>;
        interrupts = <0x00000000 0x00000018 0x00000004>;
                clocks  =  <0x00000002  0x0000005f  0x00000002
0x00000053 0x00000002 0x000000d0>;
        clock-names = "ipg", "ahb", "per";
        fsl,tuning-start-tap = <0x00000014>;
       fsl,tuning-step = <0x00000002>;
       bus-width = <0x00000008>;
       status = "okay";
       assigned-clocks = <0x00000002 0x000000d0>;
       assigned-clock-rates = <0x17d78400>;
       pinctrl-names = "default", "state_100mhz", "state_200mhz";
       pinctrl-0 = <0x00000045>;
       pinctrl-1 = <0x00000046>;
       pinctrl-2 = <0x00000047>;
       non-removable;
```

Demo nodify the mmc2(cont.)

```
u-boot=> run loadfdt
u-boot=> fdt addr ${fdt_addr_r}

u-boot=> fdt list   /aliases
aliases {
        "/soc@0/bus@30800000/ethernet@30be0000";
        gpio0 = "/soc@0/bus@30000000/gpio@30200000";

      ……
…       i2c3 = "/soc@0/bus@30800000/i2c@30a50000";
        mmc0 = "/soc@0/bus@30800000/mmc@30b40000";
        mmc1 = "/soc@0/bus@30800000/mmc@30b50000";
        mmc2 = "/soc@0/bus@30800000/mmc@30b60000";
        sai1 = "/soc@0/bus@30000000/sai@30010000";
        ……
        serial3 = "/soc@0/bus@30800000/serial@30a60000";
        spi0 = "/soc@0/bus@30800000/spi@30bb0000";
        spi1 = "/soc@0/bus@30800000/spi@30830000";
        spi2 = "/soc@0/bus@30800000/spi@30840000"
```

```
u-boot=>  fdt resize
u-boot=> fdt set  mmc2 no-1-8-v
u-boot=> fdt print  mmc2

mmc@30b60000 {
        no-1-8-v;
        compatible = "fsl,imx8mm-usdhc", "fsl,imx7d-usdhc";
        reg = <0x30b60000 0x00010000>;
        interrupts = <0x00000000 0x00000018 0x00000004>;
              clocks  =  <0x00000002  0x0000005f  0x00000002
0x00000053 0x00000002 0x000000d0>;
        clock-names = "ipg", "ahb", "per";
        fsl,tuning-start-tap = <0x00000014>;
       fsl,tuning-step = <0x00000002>;
       bus-width = <0x00000008>;
       status = "okay";
       assigned-clocks = <0x00000002 0x000000d0>;
       assigned-clock-rates = <0x17d78400>;
       pinctrl-names = "default", "state_100mhz", "state_200mhz";
       pinctrl-0 = <0x00000045>;
       pinctrl-1 = <0x00000046>;
       pinctrl-2 = <0x00000047>;
       non-removable;
```

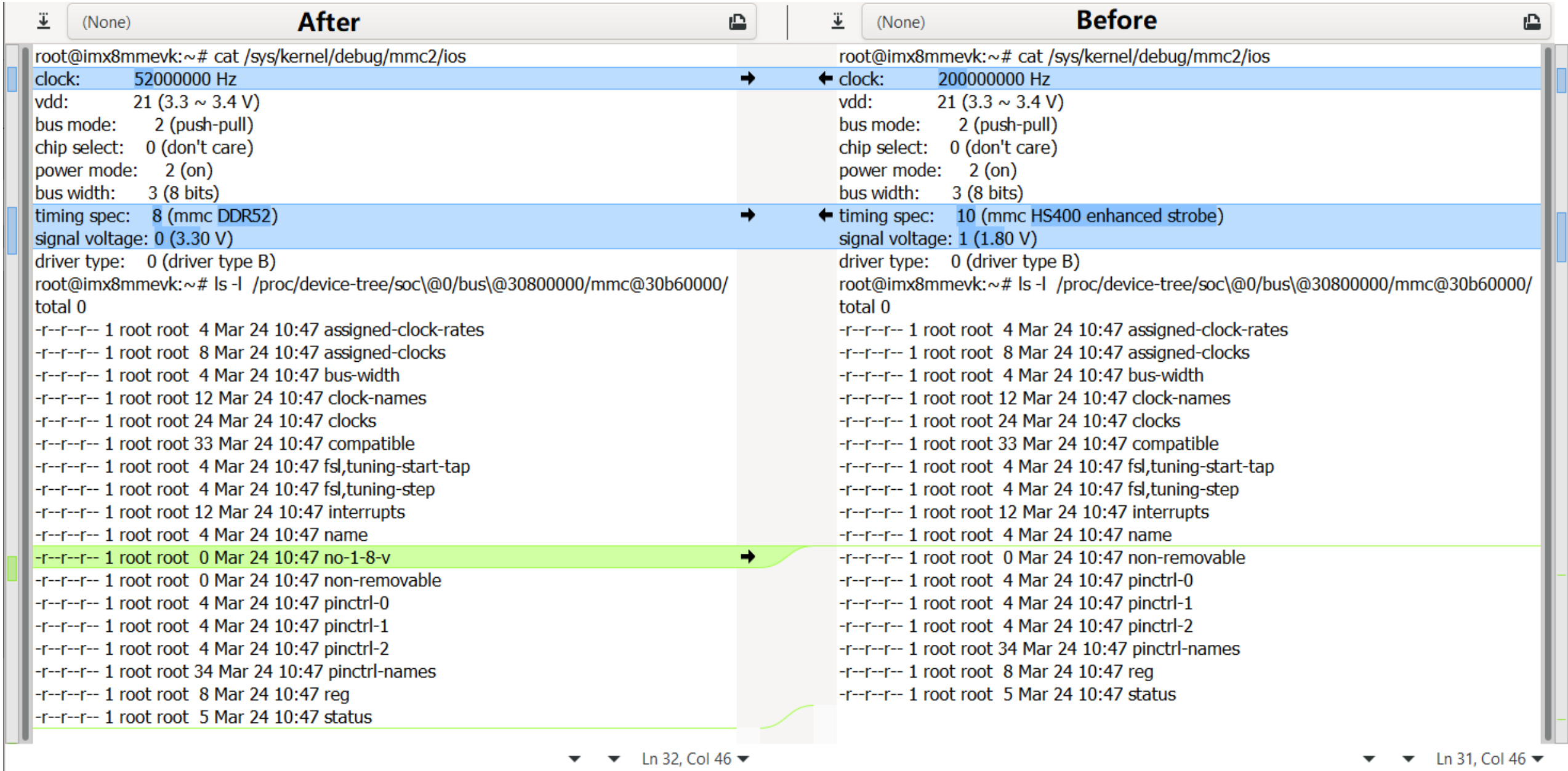
Demo nodify the mmc2(cont.)

Run following command to get into Linux again and check. Make sure

run mmcargs
run loadimage
booti ${loadaddr} - ${fdt_addr_r}

In Linux:
cat /sys/kernel/debug/mmc2/ios
ls -l /proc/device-tree/soc\@0/bus\@30800000/mmc@30b60000/

Demo nodify the mmc2(cont.)



How to get the path

In this demo, we need to know the path /soc/bus/pinctrl/gpioledgrp.
There are two ways to get it.

1. By u-boot at runtime

   run loadfdt
   fdt addr ${fdt_addr_r}
   fdt print

2. By u-boot at compile time

   ./u-boot/tools/fdtgrep imx8mm-evk.dtb

Host device-tree-compiler approach

sudo apt-get install device-tree-compiler

We also can use the fdtput of device-tree-compiler to modify the dtb(not dts) without compile it.

fdtput -t s imx8mm-evk.dtb mmc2 no-1-8-v

fdtdump imx8mm-evk.dtb |grep -C 3 no-1-8-v

```
 vmmc-supply = <0x00000044>;
        };
        mmc@30b60000 {
            no-1-8-v;
            compatible = "fsl,imx8mm-usdhc", "fsl,imx7d-usdhc";
            reg = <0x30b60000 0x00010000>;
            interrupts = <0x00000000 0x00000018 0x00000004>;
```

SECURE CONNECTIONS
FOR A SMARTER WORLD